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Claims

[c1] What is claimed is:

1.A throttle assembly of an internal combustion engine comprising:

a throttle body having an opening therethrough;

a throttle plate positioned in the opening and constructed to control passage of combustion gas through the throttle body; and

a mechanical actuator engaged with the throttle plate and having a deadband engagement therebetween whereby a portion of input motion to the mechanical actuator is not translated to the throttle plate.

[c2] 2.The throttle assembly of claim 1 further comprising a throttle linkage attached to the mechanical actuator and wherein the mechanical actuator is arranged to allow movement of the throttle linkage to accelerate the internal combustion engine while maintaining the throttle plate in a position for at least a portion of the throttle linkage movement.

[c3] 3.The throttle assembly of claim 1 further comprising an alternate air flow path in the throttle body to allow air into the internal combustion engine when the throttle

plate is in a closed position.

[c4] 4.The throttle assembly of claim 3 wherein the alternate air flow path is on a side of the throttle body generally opposite a user.

[c5] 5.The throttle assembly of claim 3 wherein the alternate air flow path includes a nozzle positioned in the throttle body on a side opposite the opening having the throttle plate therein.

[c6] 6.The throttle assembly of claim 5 wherein the alternate air flow path includes a second opening in the throttle body in communication with the opening having the throttle plate therein.

[c7] 7. The throttle assembly of claim 1 further comprising a recess in the mechanical actuator that is engagable with a throttle shaft supporting the throttle plate in the opening of the throttle body such that a position of the throttle shaft is independent of an input to the mechanical actuator in the deadband.

[c8] 8.The throttle assembly of claim 7 wherein the recess has a bowtie shaped cross-section.

[c9] 9.The throttle assembly of claim 1 wherein the mechanical actuator has an input and an output, and wherein the

throttle assembly further includes a throttle linkage attached to the input of the mechanical actuator and wherein the mechanical actuator is constructed to allow rotation of the input that exceeds rotation of the output.

[c10] 10. The throttle assembly of claim 9 wherein the rotation of the input exceeds rotation of the output by approximately 17 degrees.

[c11] 11.The throttle assembly of claim 1 wherein the dead-band engagement allows an input to the mechanical actuator to move up to approximately 20 degrees without affecting a position of the throttle plate.

[c12] 12.The throttle assembly of claim 1 wherein the mechanical actuator further comprises a first end engagable with the throttle plate and a second end engagable with a mount attached to the throttle body.

[c13] 13.The throttle assembly of claim 12 wherein the mount is a throttle position sensor and the mechanical actuator is rotatable relative thereto.

[c14] 14.The throttle assembly of claim 13 wherein the throttle plate, the mechanical actuator, and the throttle position sensor share a common axis of rotation wherein rotation of the mechanical actuator is sensed by the throttle position sensor while the throttle plate remains stationary

for a portion of a total rotation range of the mechanical actuator.

[c15] 15.The throttle assembly of claim 1 wherein the mechanical actuator has a body and an arm extending therefrom wherein the arm is pivotally connected to a throttle linkage.

[c16] 16.The throttle assembly of claim 1 incorporated into at least one of an outboard motor, an ATV, a snowmobile, and a motorcycle.

[c17] 17.An outboard motor comprising:
an engine mounted on a midsection attachable to a transom of a boat;
a throttle body attached to the engine and having a passage therethrough;
a throttle plate rotatably positioned in the passage;
a throttle linkage in operable association with the throttle plate to rotate the throttle plate in the passage of the throttle body; and
an actuator positioned between the throttle linkage and the throttle plate such that the throttle plate is disengaged from operable association with the throttle linkage during a range of engine operation.

[c18] 18.The outboard motor of claim 17 wherein the range of

engine operation is defined as an idle operation to a low speed operation.

[c19] 19.The outboard motor of claim 17 further comprising a throttle plate shaft extending through the throttle body and having the throttle plate attached thereto, an input shaft extending from the actuator, and a throttle position sensor positioned to directly sense position of the actuator input shaft.

[c20] 20.The outboard motor of claim 19 further comprising a bushing having a bearing surface and positioned about an end of the throttle plate shaft and constructed to support the actuator about the bearing surface.

[c21] 21.The outboard motor of claim 19 wherein the actuator further comprises a cylindrical body having the input shaft extending from one end and a recess constructed in an opposite end to receive a portion of the throttle plate shaft therein.

[c22] 22.The outboard motor of claim 21 wherein the throttle plate shaft has a roll pin passing therethrough that loosely engages the recess in the cylindrical body such that the actuator is free to partially rotate relative to the throttle shaft.

[c23] 23.The outboard motor of claim 21 wherein the input

shaft of the actuator is directly coupled to the throttle position sensor such that rotation of the actuator results in a change to a throttle position sensor signal.

[c24] 24.The outboard motor of claim 17 wherein the engine is operable in a stratified combustion operation and a homogeneous combustion operation and the throttle plate is mechanically disassociated with the throttle linkage when in stratified combustion operation until the engine transitions to the homogeneous combustion operation.

[c25] 25.An engine control system comprising:
a throttle linkage;
a mechanical actuator connected to the throttle linkage;
a throttle body having a first opening therein;
a throttle plate positioned in the first opening of the throttle body and rotatable between a closed position and an open position, the throttle plate rotatably connected to the mechanical actuator such that the mechanical actuator is allowed to partially rotate relative to the throttle plate in response to an input from the throttle linkage; and
an air intake bypass constructed to maintain flow of combustion air when the throttle plate is in the closed position.

[c26] 26.The engine control system of claim 25 further com-

prising a throttle plate position sensor positioned about an end of the mechanical actuator and directly coupled thereto, the throttle position sensor configured to sense rotation of the mechanical actuator.

[c27] 27.The engine control system of claim 25 wherein the air intake bypass is in the throttle body.

[c28] 28.The engine control system of claim 27 wherein the air intake bypass is in a side of the throttle body opposite that having the throttle plate therein.

[c29] 29. The engine control system of claim 25 further comprising a spacer disposed between the mechanical actuator and the throttle body and constructed to prevent wear therebetween.

[c30] 30. The engine control system of claim 25 wherein the mechanical actuator is allowed to rotate at least ten percent of a total range of rotation of the throttle plate without affecting the position of the throttle plate.

[c31] 31.A throttle assembly comprising:
a throttle linkage connected to a user input;
a throttle body having a first air intake opening;
a throttle plate rotatably positioned in the first air intake opening of the throttle body; and
a throttle translation assembly operably connecting the

throttle linkage to the throttle plate to provide translation of the throttle plate within one range of operation of the throttle linkage and prevent translation of the throttle plate in another range of operation of the throttle linkage.

[c32] 32.The throttle assembly of claim 31 wherein the throttle translation assembly comprises a rotatable body attached to an end of the throttle linkage, the rotatable body being directly rotatable with motion of the throttle linkage.

[c33] 33.The throttle assembly of claim 32 wherein the rotatable body has a stop extending therefrom to engage a boss on the throttle body at a first travel position and a tab with a bore therein to receive an end of the throttle linkage.

[c34] 34.The throttle assembly of claim 32 wherein the body of the throttle translation assembly further includes a post extending outwardly therefrom and rotatable with the body and throttle linkage.

[c35] 35.The throttle assembly of claim 34 further comprising a throttle plate shaft positioned in the throttle body to sense rotation of the post.

[c36] 36.The throttle assembly of claim 32 further comprising

a mounting bracket fixedly attached to the throttle body and having a bore to rotatably receive one end of the rotatable body therein.

[c37] 37.The throttle assembly of claim 36 wherein the throttle body includes a mounting boss extending outwardly therefrom and having at least one threaded hole to receive a fastener therein and retain the mounting bracket and the throttle translation assembly to the throttle body.

[c38] 38.The throttle assembly of claim 31 further comprising a throttle plate shaft extending through the first air intake opening and having the throttle plate mounted thereto, wherein one end of the throttle plate shaft has an engagement mechanism engagable with the throttle translation assembly.

[c39] 39.The throttle assembly of claim 38 wherein another end of the throttle plate shaft is spring biased to bias the throttle plate to a closed position in the first air intake opening.

[c40] 40.The throttle assembly of claim 38 further comprising a collar positioned over the other end of the throttle shaft and a bushing positioned between the collar and the body of the throttle translation assembly.

[c41] 41.The throttle of claim 32 wherein a throttle plate shaft extends through the first air intake opening and the throttle plate is mounted thereto, wherein one end of the throttle plate shaft has an engagement mechanism engagable with the throttle translation assembly, and wherein the rotatable body has an engagement end constructed to receive the engagement mechanism with controlled play therebetween.

[c42] 42.The throttle assembly of claim 41 wherein the controlled play includes linkage free-play of at least ten degrees before rotatable engagement with the engagement mechanism.

[c43] 43.The throttle assembly of claim 41 wherein the engagement end includes a generally annular shaped recess at a center of the body, the generally annular shaped recess having at least one opening leading to a side wall.

[c44] 44.The throttle assembly of claim 43 wherein the at least one opening leading to a side wall has a conic cross-section where the at least one opening is larger at an outer periphery than an inner periphery.

[c45] 45.The throttle assembly of claim 41 wherein the controlled play includes approximately 17 degrees of initial

body rotation before the throttle plate opens.

[c46] 46.The throttle assembly of claim 31 further comprising an air bypass tube positioned behind the throttle plate and aligned with the first intake opening communicating atmosphere to an internal passage of the throttle body.

[c47] 47.The throttle assembly of claim 46 further comprising an air temperature sensor positioned in the internal passage of the throttle body and aligned with the first intake opening and the air bypass tube.

[c48] 48. A method of minimizing noise emitted from an intake of an internal combustion engine comprising:
providing an air bypass in a location to minimize noise travel toward a user while providing sufficient air for a given range of engine operation, the air bypass having an opening open to atmosphere and directed in a direction different than that of a throttle plate; and
allowing acceleration within the given range of operation without a corresponding change in throttle plate position.

[c49] 49.The method of claim 48 wherein the given range of operation is from an idle operation to a low speed operation.

[c50] 50.The method of claim 49 wherein low speed operation

is determined when the engine transitions from a stratified combustion charge to a homogenous combustion charge.

[c51] 51.The method of claim 48 further comprising at least partially opening the throttle plate when the engine requires a generally homogeneous combustion charge.

[c52] 52.The method of claim 48 further comprising completely closing the throttle plate during deceleration of the engine prior to desiring an idle engine speed.

[c53] 53.A method of operating an internal combustion engine comprising the step of increasing an amount of fuel provided to a combustion chamber while maintaining a closed throttle plate position.